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Genitalia and Nymphs of Some New Zealand Gripopterygidae (Plecoptera)

By I. D. McLELLAN

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Abstract

THE genitalia of *Zelandobius confusus* (Hare) and *Zelandoperla fenestrata* Tillyard are described and figured. A redescription of the male genitalia of *Aucklandobius trivacuata* Tillyard is given. The nymphs of *Zelandobius confusus* (Hare), *Zelandoperla fenestrata* Tillyard, *Zelandoperla decorata* Tillyard, *Aucklandobius trivacuata* (Tillyard) is given. The nymphs of *Zelandobius confusus spiniger* (Tillyard) and *Megaleptoperla grandis* (Hudson) are described and figured. A key to nymphs to generic level and some notes on bionomics are included.

INTRODUCTION

THE early workers on N.Z. Plecoptera relied on wing venation to separate species, consequently it was not until Helson (1934) that any detailed description of genitalia was published. Kimmins (1938) described the genitalia of some species, as did McLellan (1965). The first nymph to be described and figured was that of *Stenoperla prasina* (Newman) by Hudson (1904). *Austroperla cyrene* (Newman) has been described and figured in detail by Thomson (1933). The nymphs of two apterous species were described by Wisely (1953). The nymphs and genitalia described in this paper cover most of the species of the family Gripopterygidae and I intend to complete the remainder in a later paper.

It is unfortunate that some of the type specimens no longer exist. Hare's types appear to have been destroyed, and while examining Tillyard's type specimens I noticed that the specimen labelled as the unique holotype of *Aucklandobius howesi* agreed, not with his description of *Aucklandobius howesi*, but with that of *Aucklandobius spiniger*. The differences between the two species are so distinct, especially in the pronota, that I cannot entertain the idea that Tillyard based his description of *Aucklandobius howesi* on the specimen I saw. Therefore I consider that the original has been accidentally replaced by this specimen.

As all the material in the author's collection was collected by him, the collector's name has been omitted to save unnecessary repetition.

Family GRIPOPTERYGIDAE Enderlein, 1909

The genera of this family were included in the Leptoperlidae as defined by Tillyard (1921 and 1923). Kimmins (1951) opposed the retention of this family name and outlined his reasons why it should give way to Enderlein's Gripoptery-

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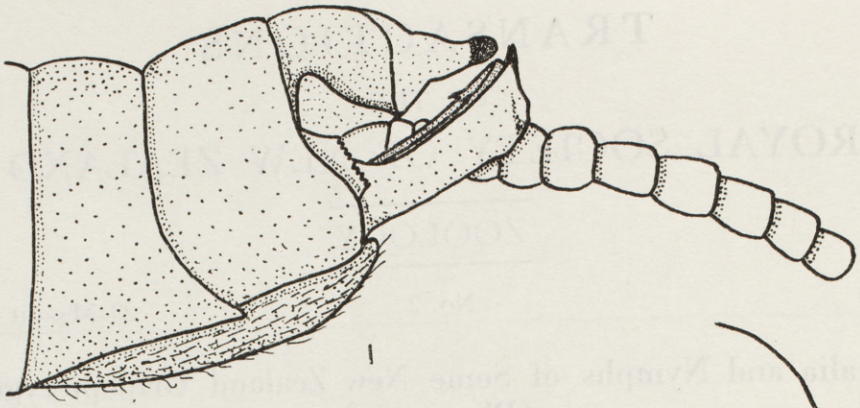
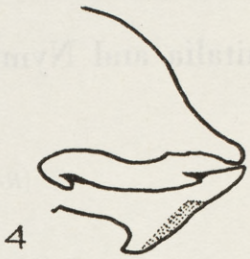
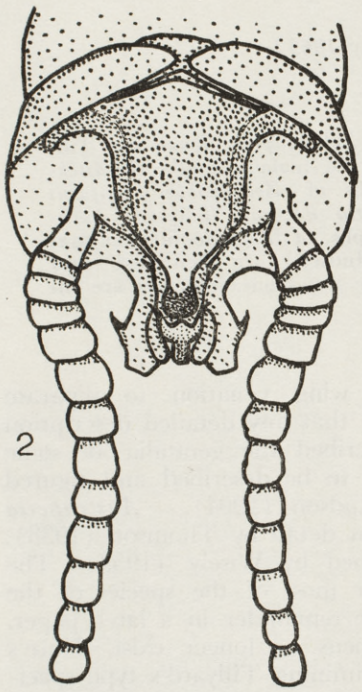
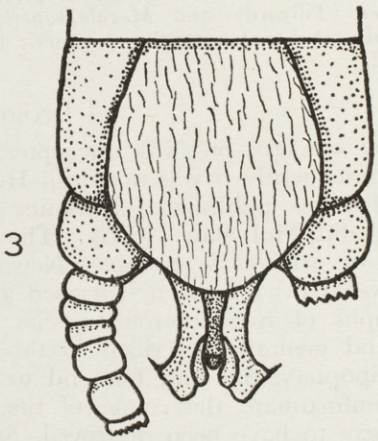
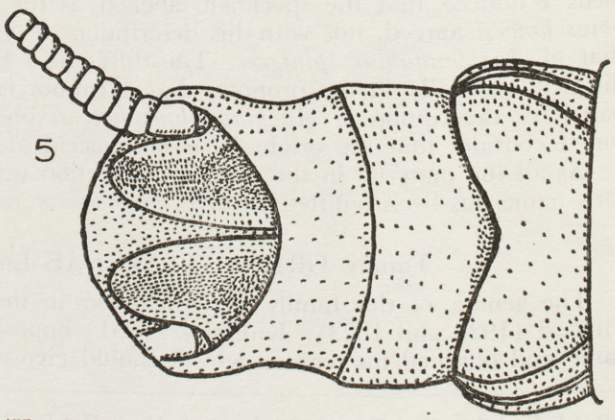
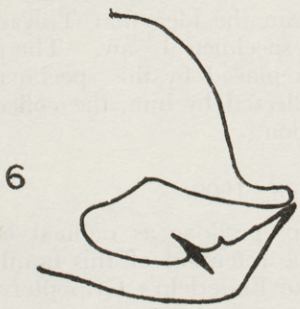












FIGS. 1–5.—*Zelandobius confusus* (Hare). Fig. 1—Male genitalia, lateral view. Fig. 2—Male genitalia, dorsal view. Fig. 3—Male genitalia, ventral view. Fig. 4—Male, epiproct. Fig. 5—Female genitalia, ventral view. Fig. 6—*Zelandobius furcillatus* Tillyard. Male, epiproct.

gidae on the grounds of priority. This change has been accepted by Wisely (1953) and Illies (1963). The latter has redefined Gripopterygidae and divided it into five subfamilies, placing the New Zealand genera as follows: *Megaleptoperla* Tillyard in Gripopteryginae Enderlein; *Zelandoperla* Tillyard, *Aucklandobius* Enderlein and *Apteryoperla* Wisely in Leptoperlinae Banks; *Zelandobius* Tillyard (with reservations) in Antarctoperlinae Enderlein.

Diagnosis of Family (after Illies).

A family of the suborder Filipalpia with the following features: Small to medium sized animals (forewing 5–20mm). Forewing with a number of irregular cross-veins in the distal half. Rs usually short or long forked. M always forked, Cu_1 forked or unforked. Three anal veins usually with a condensed cross-vein between A_1 and A_2. Hind wing resembling the forewing, but with six anal veins, the last fused with the hind margin so that there are apparently five anal veins. A_1 to A_6 with no cross-veins. Cerci feeler-like, either long with many segments or short with a minimum of 5–6 segments.

Zelandobius confusus (Hare, 1910)

Leptoperla confusa Hare, 1910. *Trans. N.Z. Inst.* 42: 29.
Zelandobius confusus: Tillyard, 1923. *Trans. N.Z. Inst.* 51: 206.

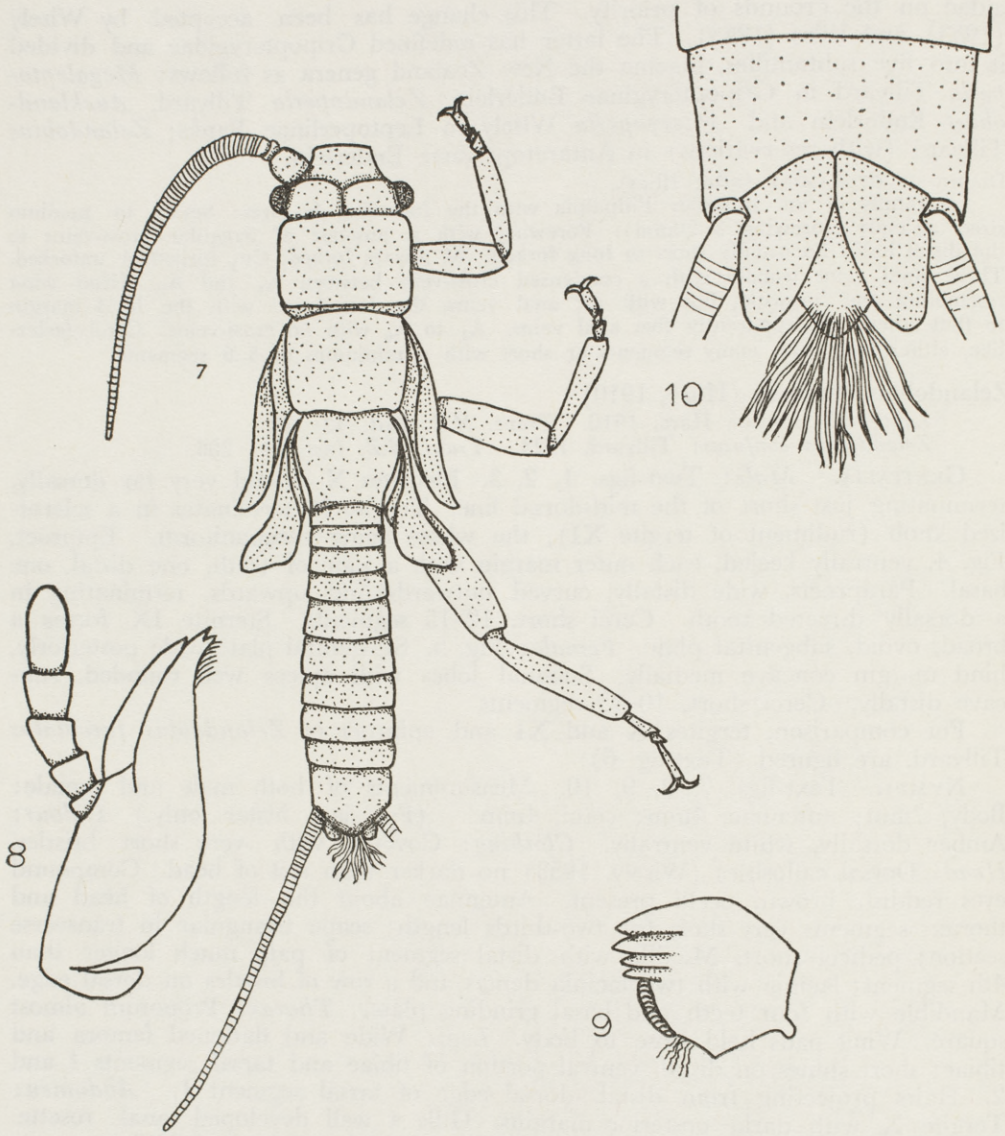
Genitalia. *Male*: Text-figs. 1, 2, 3. Pleurites X extend very far dorsally, terminating just short of the mid-dorsal line. Tergite X terminates in a sclerotized knob (rudiment of tergite XI), the whole being campaniform. Epiproct, Fig. 4, ventrally keeled, each outer margin with a pair of teeth, one distal, one basal. Paraprocts, wide distally, curved outwards and upwards, terminating in a dorsally directed tooth. Cerci short, 12–15 segments. Sternite IX forms a broad, ovoid, subgenital plate. *Female*: Fig. 5. Subgenital plate wide posteriorly, hind margin concave medially. Subanal lobes with apices well rounded, concave distally. Cerci short, 10–13 segments.

For comparison, tergites X and XI and epiproct of *Zelandobius furcillatus* Tillyard, are figured (Text-fig. 6).

Nymph. Text-figs. 7, 8, 9, 10. Measurements of both male and female: Body, 7mm; antennae, 4mm; cerci, 4mm. (For last instar only.) *Colour*: Amber dorsally, white ventrally. *Clothing*: Covered with very short bristles. *Head*: Dorsal callosities (Wisely, 1953) no darker than rest of head. Compound eyes reddish brown, ocelli present. Antennae about the length of head and thorax; segments very short for two-thirds length; scape triangular in transverse section; pedicel short. Maxilla with distal segment of palp much longer than 4th segment; lacinia with two lacinia dentes and a row of bristles on dorsal edge. Mandible with four teeth and basal grinding plate. *Thorax*: Pronotum almost square. Wing pads held close to body. *Legs*: Wide and flattened femora and tibiae; short spines on distal, ventral portion of tibiae and tarsal segments 1 and 2. Hairs projecting from distal, dorsal edge of tarsal segment 1. *Abdomen*: Tergite X with dark, posterior margins. Gills a well developed anal rosette. Cerci as long as thorax, 40–50 segments. Subanal lobes tongue shaped.

Material: Author's collection: Ten Mile Creek (Lower Buller Gorge), 3 nymphs, —/iii/63; 1 nymph, —/v/64; 2 nymphs, 24/vi/64; 1 male, 10/vii/64; 1 male and associated exuvia, 1 female and associated exuvia, 1 female, 2 nymphs, 29/viii/64; 3 males, 1/viii/64; 4 males, 1 female, 10/ix/64; 1 male and associated exuvia, 3 males, 2 females, 28/xi/64; 2 nymphs, 29/v/65; 3 nymphs, 5/vi/65; 14 Mile Creek (14 miles N. of Greymouth, 100 yards from sea), 3 males, 3/vii/65; Fuchsia Creek (Lower Buller Gorge), 3 nymphs, 18/iv/65; Ohikanui River, 4 males, 5 females, 26/ix/64; 4 males, 6 females, 4/x/64; 1 male, 1 female, 5/xii/64; Tiropahi River, 1 male, 2 females, 11/i/65; Canterbury Museum collection: Toruarau Hill, Napier, 1 male, 2 females, 20/i/64, P. M. Johns; Sudden Stream, Cass, 1 male, 10/xi/62, J. R. Jackson; "Coll. 9", 1 female, D. Craig.

Bionomics. Nymphs were found both beneath stones and detritus in moderate to fast currents of streams. Emerging imagines and mature nymphs were collected from under stones on the stream margin. The remaining imagines were found



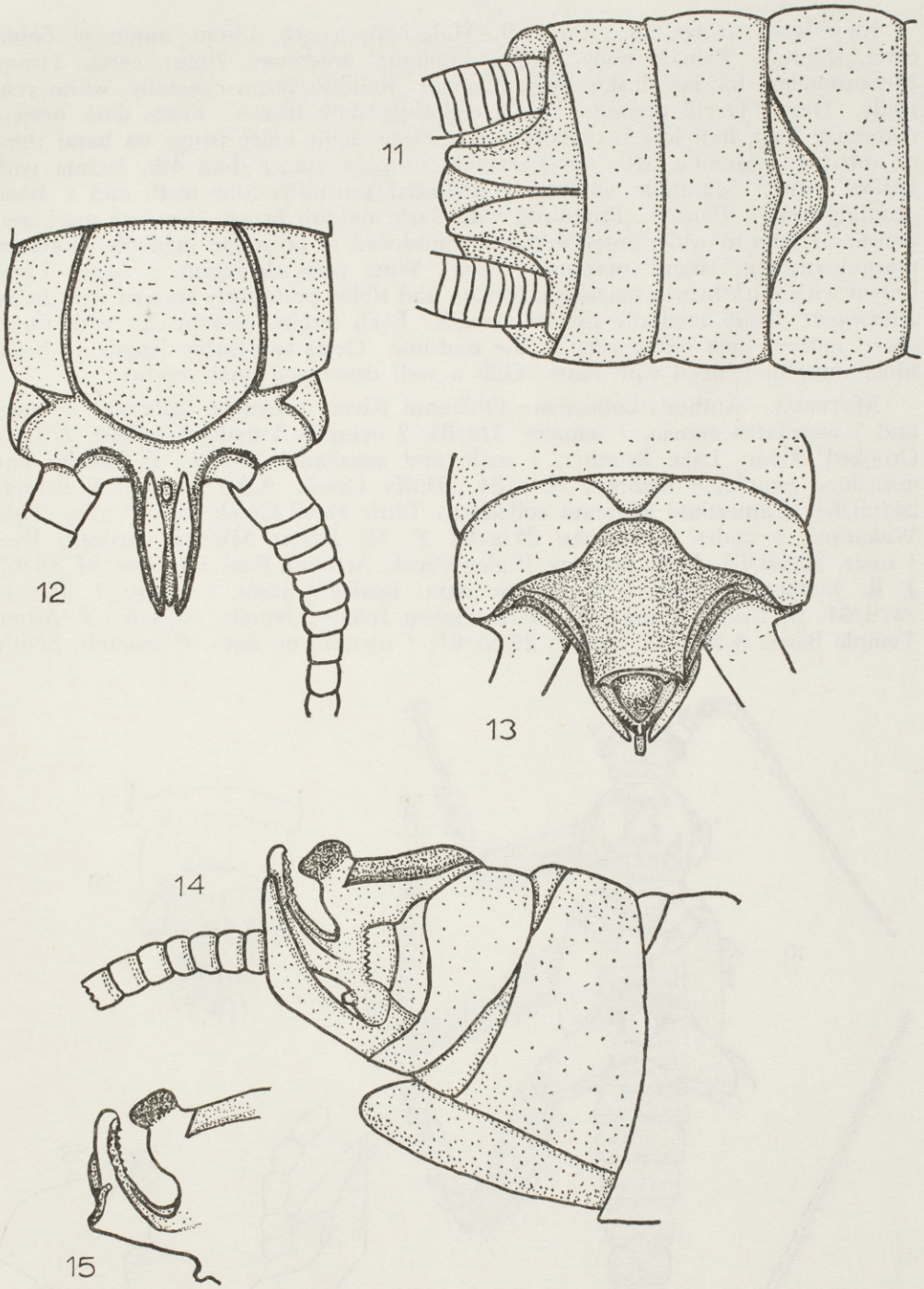
FIGS. 7–10.—Nymph of *Zelandobius confusus* (Hare). Fig. 7—Dorsal view of nymph. Fig. 8—Right maxilla, ventral view. Fig. 9—Left mandible, ventral view. Fig. 10—Tip of abdomen, ventral view.

in sunny localities and on vegetation adjacent to streams. When disturbed the nymph waggles its abdomen from side to side.

Zelandoperla fenestrata Tillyard, 1923

Zelandoperla fenestrata Tillyard, 1923. *Trans. N.Z. Inst.* 54: 214–215.

GENITALIA. *Male*: Text-figs. 12, 13, 14, 15. Pleurites X extend very far dorsally, fusing distally. Tergite X, from dorsal aspect, pentagonal with posterior angles produced either side of tergite XI. Tergite XI subtriangular, its base divided from tergite X by an unsclerotized strip. Epiproct curving uniformly upwards, its rounded tip level with and slightly behind tergite XI, distal half edged dorsally with teeth, ventral keel produced to a point, a small knob projecting ventrally at base. Paraprocts wide medially and pointed distally. Sternite

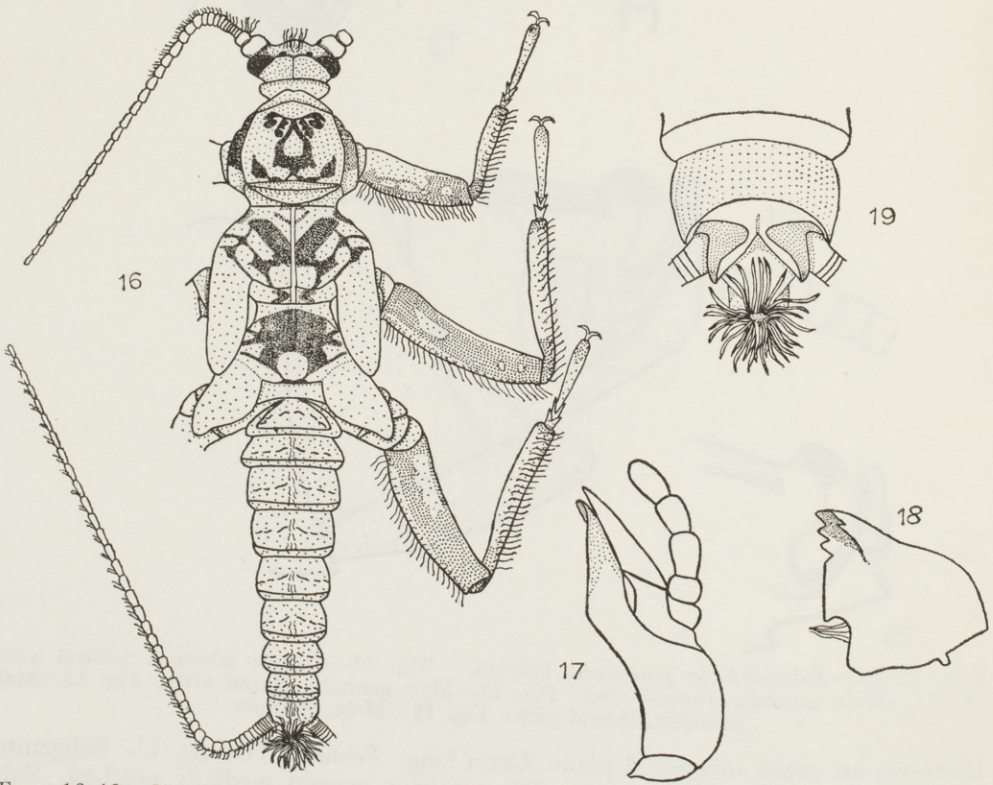


Figs. 11–15.—*Zelandoperla fenestrata* Tillyard. Fig. 11—Female genitalia, ventral view. Fig. 12—Male genitalia, ventral view. Fig. 13—Male genitalia, dorsal view. Fig. 14—Male genitalia, lateral view. Fig. 15—Male, epiproct.

IX forms an ovoid subgenital plate. Cerci long. *Female*: Text-fig. 11. Subgenital plate not produced on to sternite IX, posterior margin medially notched. Subanal lobes with strongly concave outer margins, apices divergent, tapered and rounded. Cerci long.

Nymph. Text-figs. 16, 17, 18, 19. Male body length, 13mm; antennae, 6mm; cerci, 10mm. Female body length, 15.5mm; antennae, 7mm; cerci, 11mm. Measurements for last instar only. *Colour*: Reddish brown dorsally, white ventrally. *Head*: Ocelli present. Dorsal callosities dark brown. Frons dark brown. Antennae long, half length of body, scape wide; light hairy fringe on basal third of antennae. Maxilla with distal segment of palp longer than 4th, lacinia with hollow dente. Mandible with apex hollowed ventrally, four teeth and a basal grinding plate. *Thorax*: Pronotum with dark, reddish brown, lyre-like markings; almost as long as wide, anterior margin produced to an angle medially, posterior margin straight, lateral margins convex. Wing pads divergent. *Legs*: Light brown with dark brown markings, femora and tibiae posteriorly fringed with hairs. *Abdomen*: Hairy medially for full length. Each tergite (except X) with three, short, curved lines either side of the mid-line. Cerci two-thirds length of body, inner margins fringed with hairs. Gills a well developed anal rosette.

Material. Author's collection: Ohikanui River, 1 female, 22/x/62, 7 males and 1 associated exuvia, 7 females, 3/x/64, 2 nymphs, 1 male, 1 female, 7/ii/65. Crooked River, Lake Brunner, 1 male and associated exuvia, 1 female and associated exuvia, 4 nymphs, 10/x/64. Duffy Creek, Rahu Saddle, 1 nymph, 24/xii/64. Canterbury Museum collection: Little Devil Creek, Rees Valley, Lake Wakatipu, 4 males, 5 nymphs, 24/x/64, P. M. Johns; Mingha, Arthur's Pass, 1 male, 30/xii/62, J. R. Jackson; Pegleg Creek, Arthur's Pass, 1 female, 27/xii/62, J. R. Jackson; 1 male, 1 female, no data; Bealey Chasm, 1 male, 1 female, 23/ii/64, D. Craig; Mangaraka, West Haven Inlet, 1 female, —/x/64, P. Aston; Temple Basin, 4,500ft, 1 female, 22/iii/64; 1 nymph, no data; Chaslands, South-



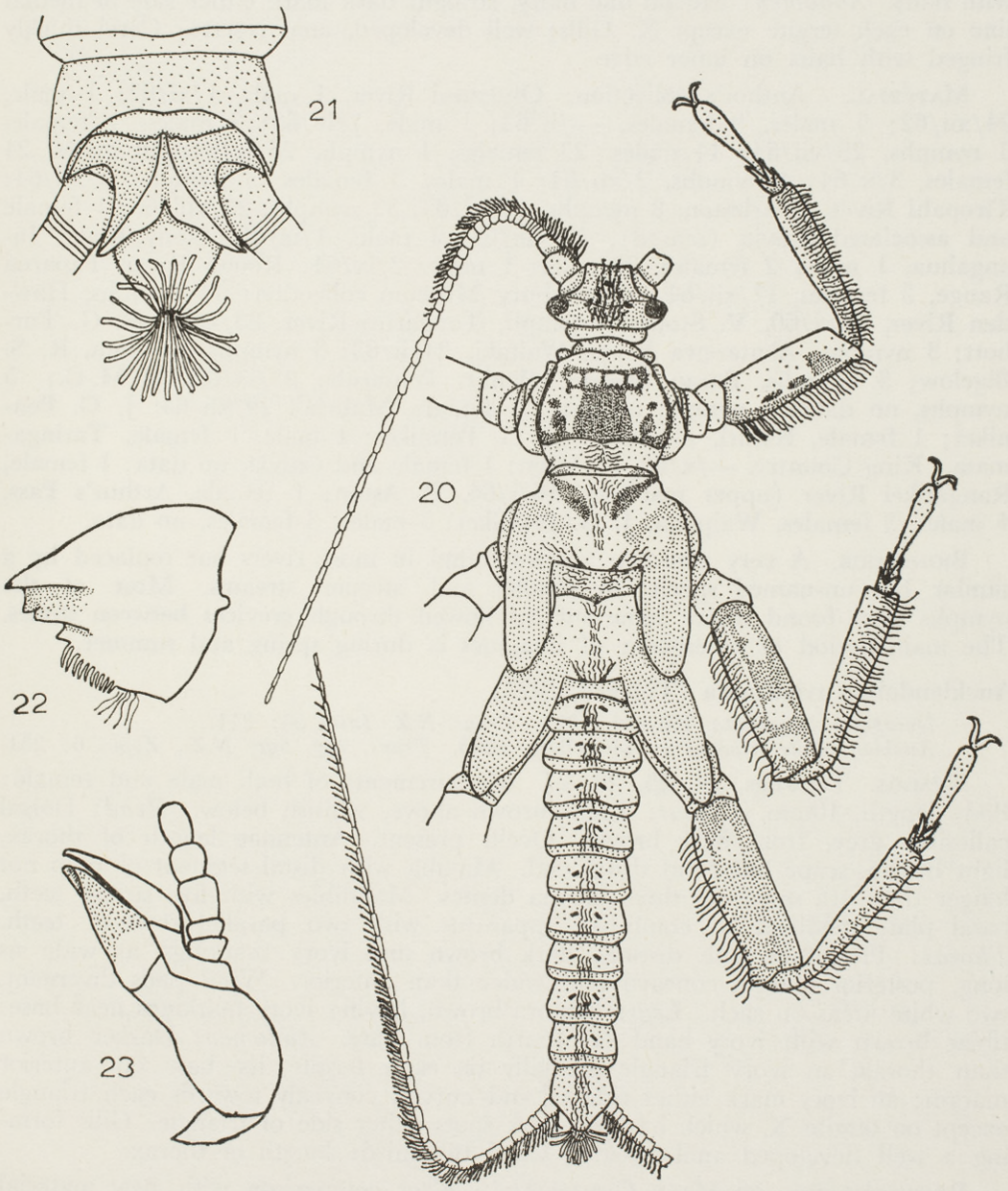
Figs. 16–19.—Nymph of *Zelandoperla fenestrata* Tillyard. Fig. 16—Dorsal view of nymph. Fig. 17—Left maxilla, ventral view. Fig. 18—Left mandible, ventral view. Fig. 19—Tip of abdomen, ventral view.

land, 1 nymph, 5 exuviae, 3/iii/65, J. G. Penniket; Coronation Peak, Fiordland, 1 female, —/i/55, E. G. Turbott; Betwixt, Cass, 3 nymphs, 12/x/60, V. M. Stout; Hawden River, Cass, 1 nymph, 13/x/60, V. M. Stout; 1 nymph, no data; Portia Creek, Boulder Lake, Nelson, 10 nymphs, 28/x/63, V. M. Stout; 2 nymphs, no data. Type specimens also examined, D.S.I.R., Nelson.

Zelandoperla decorata Tillyard, 1923

Zelandoperla decorata Tillyard, 1923. *Trans. N.Z. Inst.* 54: 213–214.

Nymph. Text-figs. 20, 21, 22, 23. Measurements of both male and female: Body length, 11.5mm; antennae, 8mm; cerci, 9.5mm. (For last instar only.) *Colour*: Brown to dark brown dorsally, with distinctly darker markings, ventrally



Figs. 20–23.—Nymph of *Zelandoperla decorata* Tillyard. Fig. 20—Dorsal view of nymph. Fig. 21—Tip of abdomen, ventral view. Fig. 22—Left mandible, ventral view. Fig. 23—Left maxilla, ventral view.

white. *Head*: Epicranial plates thickly covered with small, light brown patches outlined with dark brown; having a medial area of hairs extending on to the frons. Frons dark brown. Ocelli present, dark and prominent. Antennae long, fringed with hairs for one-third basal length. Scape large. Maxilla with distal segment of palp longer than 4th segment; one hollowed lacinia dente. Mandible with apex hollowed ventrally and having three teeth; basal grinding plate modified to a comb-like apparatus. *Thorax*: Hairy areas at posterior of pro-, meso-, and meta-nota. Medial line of hairs on meso- and meta-nota. Pronotum wider than long, narrowing anteriorly, lateral and anterior margins convex, posterior margins slightly concave; lyre-like markings. Wing pads divergent. *Legs*: Dorsally dark brown with light patches on femora; tibiae and femora thickly fringed with hairs. *Abdomen*: Medial line hairy, straight dark mark either side of medial line on each tergite except X. Gills; well developed, anal rosette. Cerci thickly fringed with hairs on inner edge.

MATERIAL. Anthor's collection: Ohikanui River, 1 male, 1/xi/62; 1 male, 24/xii/62; 5 males, 9 females, —/ii/63; 1 male, 7/iv/63; 3 males, 1 female, 3 nymphs, 25/vii/64; 14 males, 23 females, 1 nymph, 26/ix/64; 38 males, 24 females, 3/x/64; 4 nymphs, 2/xii/64; 4 males, 3 females, 3 nymphs, 5/xii/64; Tiropahi River, Charleston, 8 nymphs, 30/vi/63; 33 nymphs, 24/viii/63; 1 female and associated exuvia (reared), 30/viii/63; 1 male, 1/ix/63; Stony River, Inangahua, 1 male, 2 females, 28/x/62; 1 male, 2/ix/64; Rough River, Paparoa Range, 3 females, 17/xii/64. Canterbury Museum collection: 11 nymphs, Hawden River, 13/x/60, V. Stout; 1 nymph, Tongariro River, 23/x/49, E. G. Turbott; 3 nymphs, Akatarewa River, Waitaki, 24/ii/63; 3 nymphs, no data, R. S. Bigelow; 3 nymphs, Purau Stream, Banks Peninsula, 23/ix/62, M. M. C.; 5 nymphs, no data; 1 nymph, no data; 1 female, Mahria? 29/xii/64, J. G. Penniket; 1 female, Kokiri, —/xii/62, J. G. Penniket; 1 male, 1 female, Taringamata, King Country, —/x/63, P. Aston; 1 female and exuvia, no data; 1 female, Rangatikei River (upper reaches), 16/i/64, P. Aston; 1 female, Arthur's Pass, 4 males, 2 females, Waipoua, J. G. Penniket; 3 males, 3 females, no data.

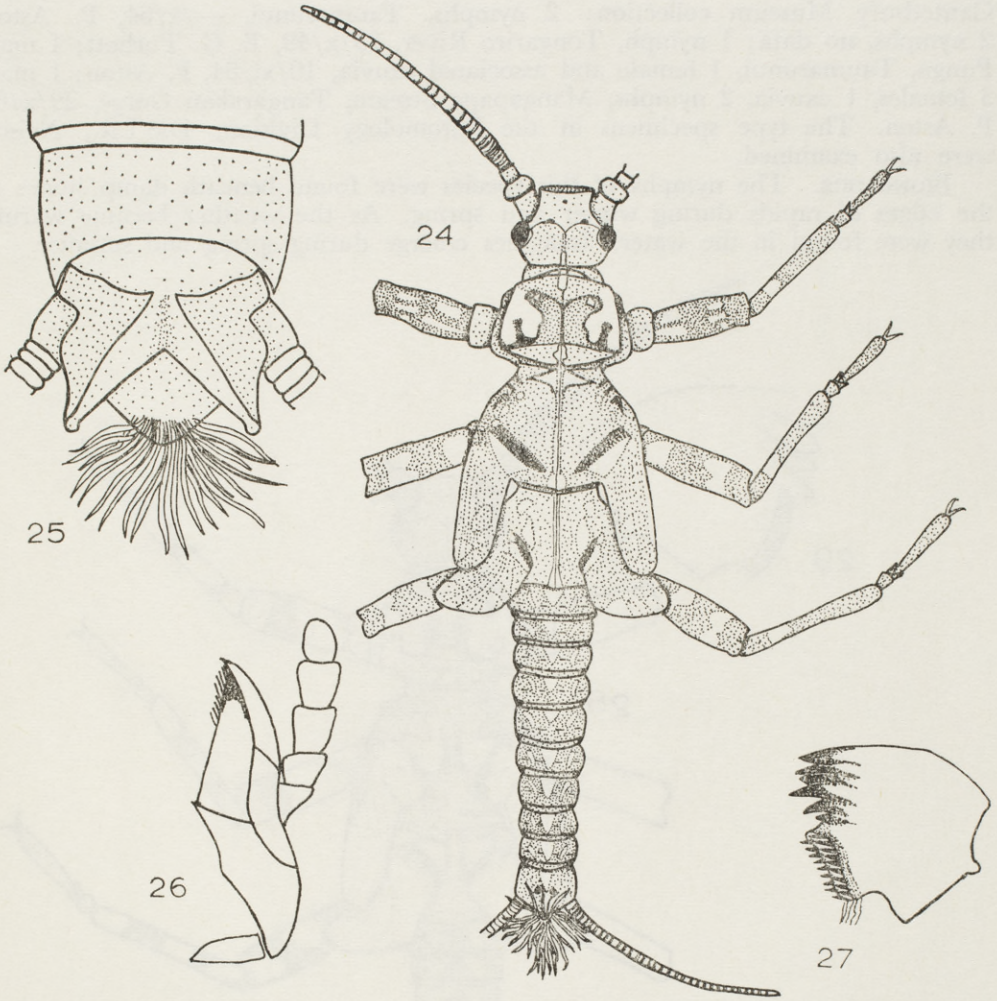
BIONOMICS. A very common species found in most rivers but replaced by a similar but un-named species in smaller and steeper streams. Most of the nymphs were found where some current flowed through crevices between stones. The main period of emergence of imagines is during spring and summer.

Aucklandobius trivacuata (Tillyard, 1923)

Nesoperla trivacuata Tillyard, 1923. *Trans. N.Z. Inst.*, 54: 211.
Aucklandobius trivacuata: McLellan, 1965. *Trans. roy. Soc. N.Z., Zool.*, 6: 231.

NYMPH. Text-figs. 24, 25, 26, 27. Measurements of both male and female: Body length, 10mm. *Colour*: Light brown above, whitish below. *Head*: Dorsal callosities grey, frons dark brown. Ocelli present. Antennae length of thorax, light brown, scape bulges at distal end. Maxilla with distal segment of palp not longer than 4th segment; three lacinia dentes. Mandibles with five strong teeth, basal plate modified to comb-like apparatus with two parallel rows of teeth. *Thorax*: Pronotum with distinct dark brown and ivory markings, as wide as long, posterior margin concave and wider than anterior. Wing pads divergent, two white areas on each. *Legs*: Femora brown, having ivory markings near base; tibiae brown with ivory band one-fourth from base. *Abdomen*: Darker brown than thorax, an ivory triangle medially on each tergite, its base on anterior margin; an ivory mark either side of and curved convexly towards each triangle except on tergite X, which has two dark spots either side of triangle. Gills forming a well developed anal rosette. Cerci two-thirds length of thorax.

REDESCRIPTION OF MALE GENITALIA. After comparison with new material and the holotype, distortion was noticed in the specimens used by the author for his original description; (McLellan, 1965) tergites X and XI and the epiproct



Figs. 24–27.—Nymph of *Aucklandobius trivacuata* (Tillyard). Fig. 24—Dorsal view of nymph. Fig. 25—Tip of abdomen, ventral view. Fig. 26—Left maxilla, ventral view. Fig. 27—Left mandible, ventral view.

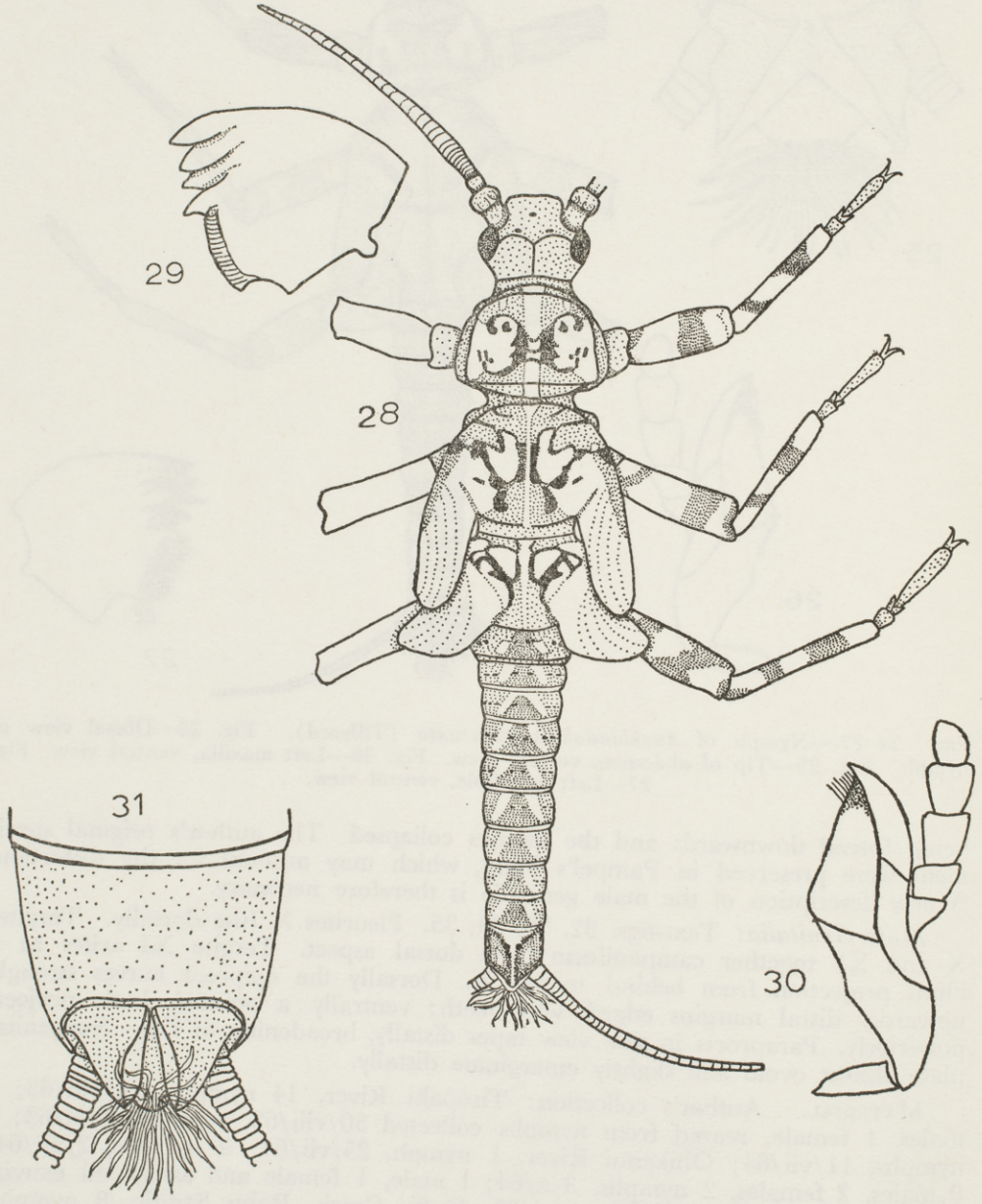
being forced downwards and the tergites collapsed. The author's original specimens were preserved in Pampel's Fluid, which may account for the distortion. A new description of the male genitalia is therefore necessary.

Male Genitalia: Text-figs. 32, 33, 34, 35. Pleurites X fuse dorsally. Tergites X and XI together campaniform from dorsal aspect. Tergite XI arises as a blunt projection from behind tergite X. Dorsally the epiproct curves strongly upwards, distal margins edged with teeth; ventrally a pointed keel projects posteriorly. Paraprocts in side view taper distally, broadening at tips. Subgenital plate almost ovoid and slightly emarginate distally.

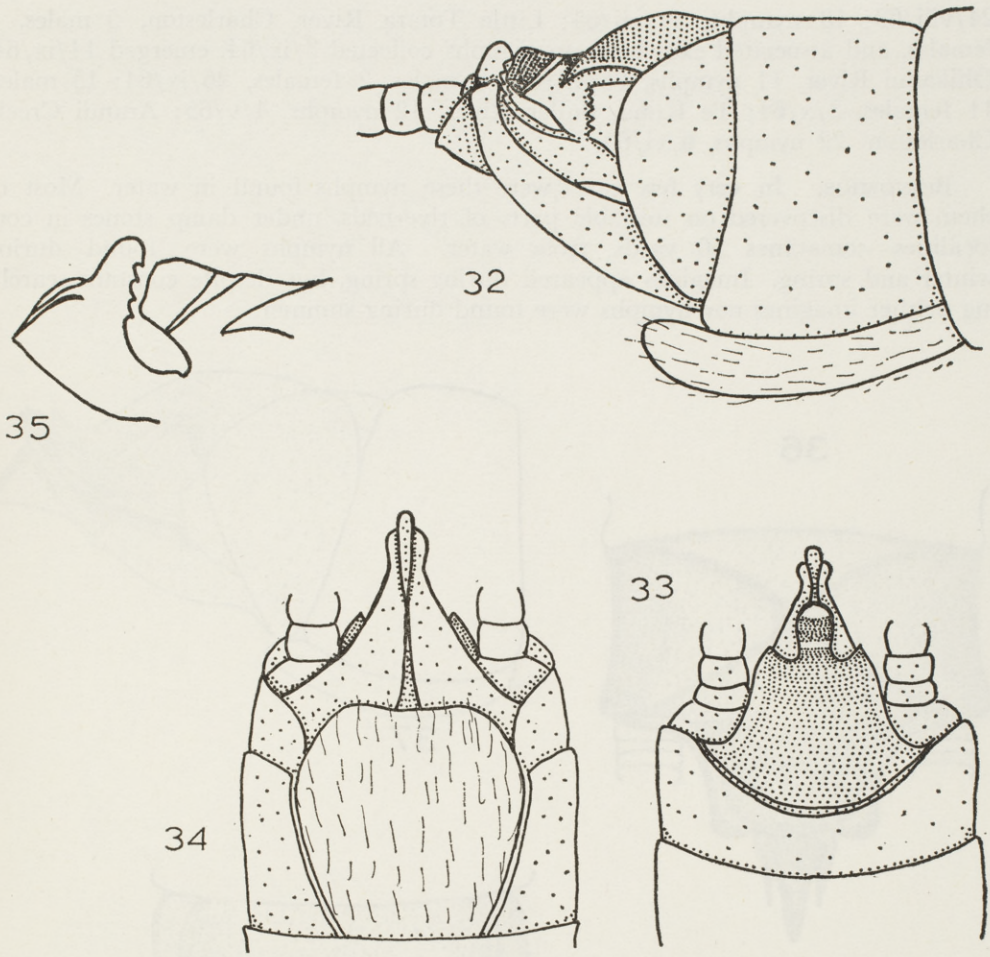
Material. Author's collection: Tiropahi River, 14 nymphs, 24/viii/63; 4 males, 1 female, reared from nymphs collected 30/viii/63, emerged 1/ix/63; 3 nymphs, 11/vii/64; Ohikanui River, 1 nymph, 25/vii/64; 9 nymphs, 2/xii/64; 8 males, 2 females, 2 nymphs, 3/x/64; 1 male, 1 female and associated exuvia, 5/xii/64; 2 males, 1 female, 1/xi/62; Duffy Creek, Rahu Saddle, 8 nymphs, 24/xii/64; Rough River, Grey Valley, 7 nymphs, 16/xii/64; Crooked River, Lake Brunner, 4 nymphs, 10/x/64; Te Kuha, Buller River, 1 nymph, 4/v/65;

Canterbury Museum collection: 2 nymphs, Taumarunui, —/x/64, P. Aston; 2 nymphs, no data; 1 nymph, Tongariro River, 23/x/49, E. G. Turbott; 1 male, Punga, Taumarunui, 1 female and associated exuvia, 10/xi/64, P. Aston; 1 male, 3 females, 1 exuvia, 2 nymphs, Mangapapa Stream, Tangarakau Gorge, 29/x/64, P. Aston. The type specimens in the Entomology Division, D.S.I.R., Nelson, were also examined.

Bionomics. The nymphs of this species were found beneath damp stones on the edges of rapids during winter and spring. As the weather became warmer they were found in the water. Imagines emerge during spring and summer.



Figs. 28–31.—Nymph of *Aucklandobius fulvescens* (Hare). Fig. 28—Dorsal view of nymph. Fig. 29—Left mandible, ventral view. Fig. 30—Left maxilla, ventral view. Fig. 31—Tip of abdomen, ventral view.



Figs. 32–35.—*Aucklandobius trivacuata* Tillyard. Fig. 32.—Male genitalia, lateral view. Fig. 33—Male genitalia, dorsal view. Fig. 34—Male genitalia, ventral view. Fig. 35—Male, epiproct.

Aucklandobius fulvescens (Hare, 1910)

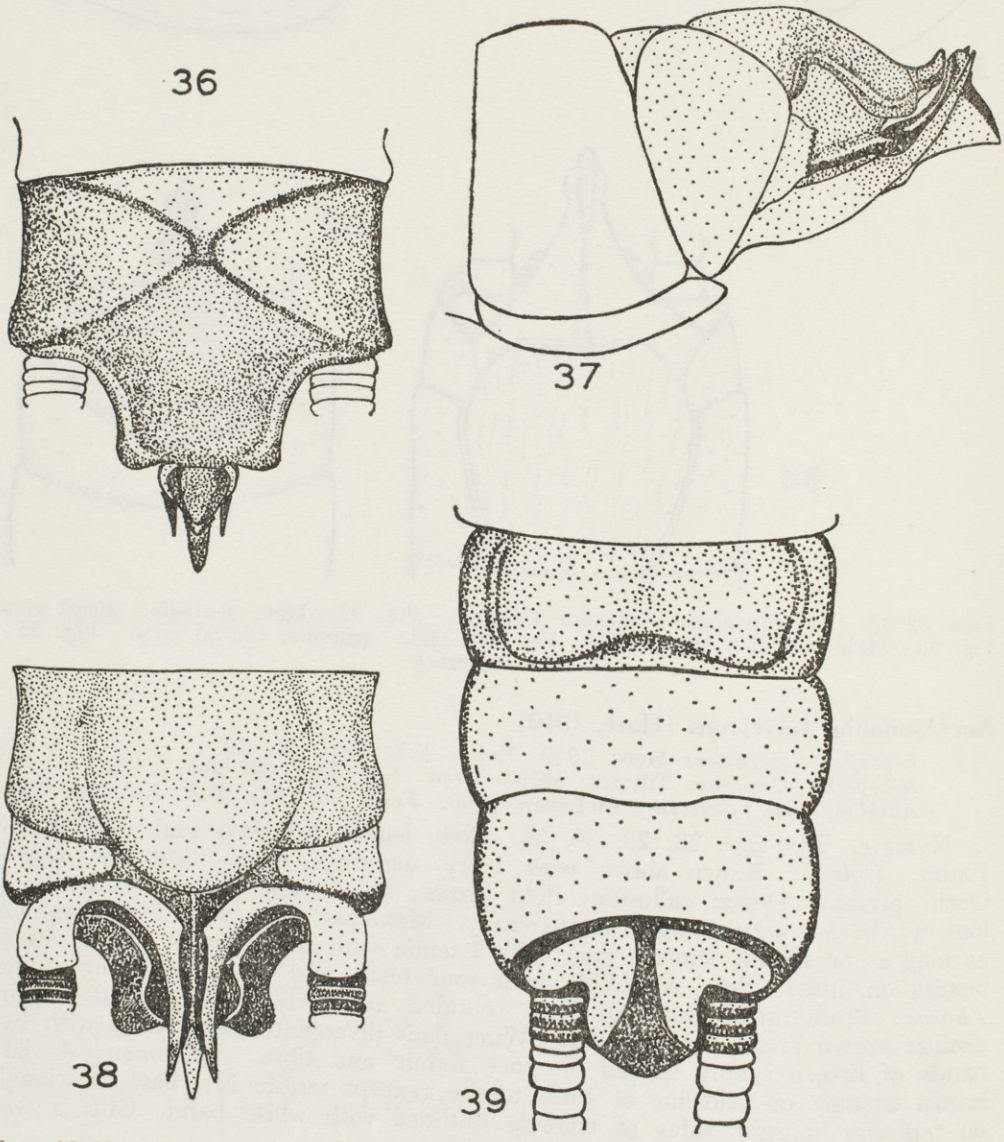
Leptoperla fulvescens Hare, 1910. *Trans. N.Z. Inst.*, 42: 29.
Nesoperla fulvescens: Tillyard, 1923. *Trans. N.Z. Inst.*, 54: 209.
Aucklandobius fulvescens: McLellan, 1965. *Trans. roy. Soc. N.Z., Zool.*, 6: 230.

Nymph. Text-figs. 28, 29, 30, 31. Body length for both male and female 10mm. *Colour*: Brown above with ivory markings, ivory ventrally. *Head*: Ocelli present. Dorsal callosities light brown, frons dark brown. Antennae as long as thorax, scape bulges at extremity. Maxillary palp with distal segment as long as or slightly shorter than 4th. Lacinia with three dentes and a row of bristles on inner edge. Mandible with four teeth and basal grinding plate. *Thorax*: Pronotum wider than long, rounded anteriorly, straight hind margin, distinct brown and ivory markings. Wing pads divergent. *Legs*: Grey with two bands of brown evenly spaced on each femur and tibia. *Abdomen*: A dark brown triangle on mid-line of each tergite (except tergite X), base of triangle on posterior margin, sides of triangle outlined with white band. Gills a well developed anal rosette. Cerci as long as thorax.

Material. Author's collection: Tiropahi River, 6 males, 4 females, and associated exuviae from nymphs collected 30/viii/63, emerged 1/ix/63; 33 nymphs,

24/viii/63; 18 nymphs, 11/vii/64; Little Totara River, Charleston, 5 males, 4 females, and associated exuviae from nymphs collected 3/ix/64, emerged 14/ix/64. Ohikanui River, 11 nymphs, 25/vii/64; 6 males, 2 females, 26/ix/64; 15 males, 11 females, 3/x/64; Te Kuha, Buller River, 12 nymphs, 4/v/65; Aranui Creek, Charleston, 22 nymphs, 6/vi/65.

Bionomics. In very few cases were these nymphs found in water. Most of them were discovered on unstable parts of riverbeds, under damp stones in cool localities—sometimes 50 yards from water. All nymphs were found during winter and spring. Imagines appeared during spring, but despite constant searching neither imagines nor nymphs were found during summer.



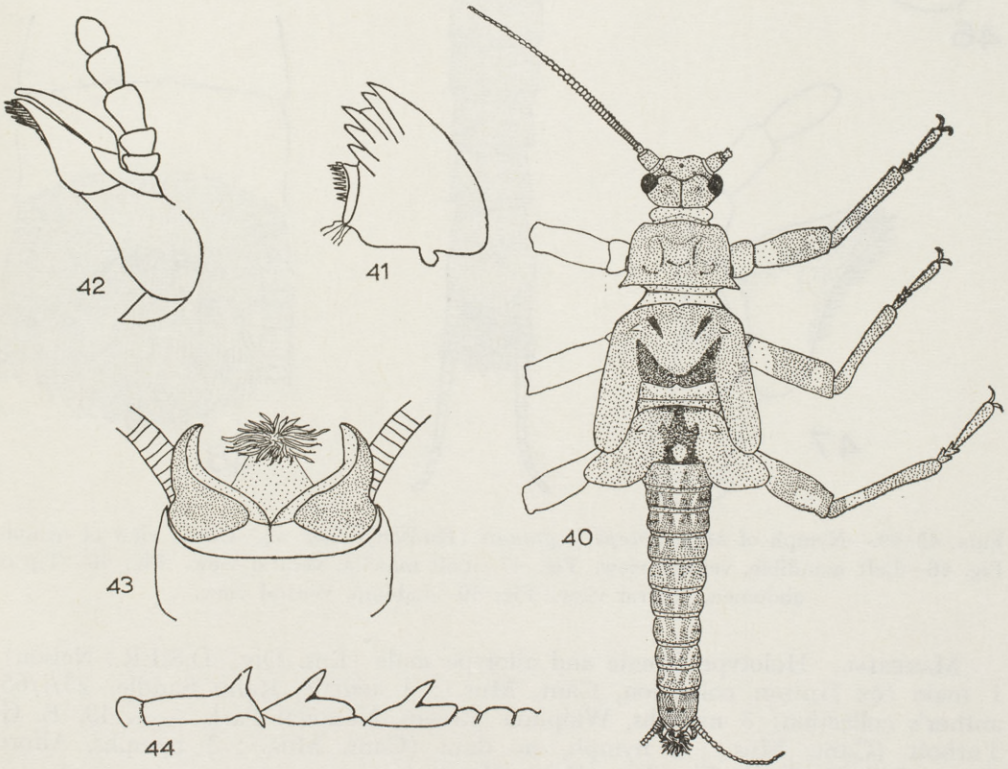
Figs. 36–39.—*Aucklandobius spiniger* (Tillyard). Fig. 36—Male genitalia, dorsal view. Fig. 37—Male genitalia, lateral view. Fig. 38—Male genitalia, ventral view. Fig. 39—Female genitalia, ventral view.

Aucklandobius spiniger (Tillyard, 1923)

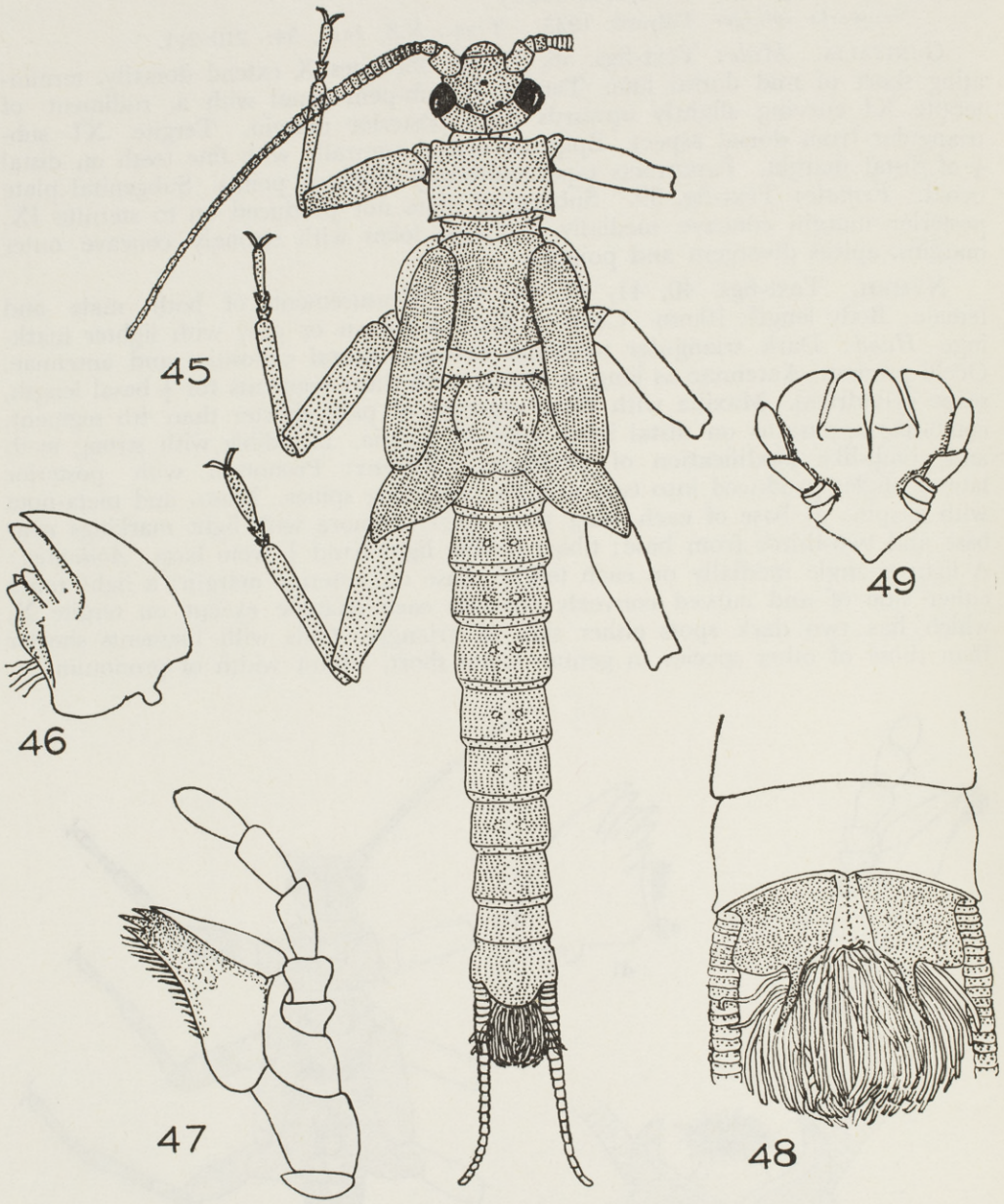
Nesoperla spiniger Tillyard, 1923. *Trans. N.Z. Inst.*, 54: 210–211.

Genitalia. *Male*: Text-figs. 36, 37, 38. Pleurites X extend dorsally, terminating short of mid dorsal line. Tergite X sub-pentagonal with a rudiment of tergite XI curving slightly upwards from posterior margin. Tergite XI sub-triangular from dorsal aspect. Epiproct keeled ventrally with fine teeth on distal $\frac{1}{4}$ of distal margin. Paraprocts taper uniformly to sharp points. Subgenital plate ovoid. *Female*: Text-fig. 39. Subgenital plate not produced on to sternite IX, posterior margin concave medially. Subanal lobes with strongly concave outer margins, apices divergent and pointed.

Nymph. Text-figs. 40, 41, 42, 43, 44. Measurements of both male and female: Body length 10mm. *Colour*: Reddish brown or grey with lighter markings. *Head*: Dark triangular markings between dorsal callosities and antennae. Ocelli present. Antennae as long as thorax with short segments for $\frac{1}{2}$ basal length, scape cylindrical. Maxilla with distal segment of palp shorter than 4th segment, comb-like apparatus on distal inner edge of lacinia. Mandible with strong teeth and comb-like modification of prostheca. *Thorax*: Pronotum with posterior lateral angles produced into two strongly projecting spines. Meso- and meta-nota with a spine at base of each wing pad. *Legs*: Femora with light markings near base and two-thirds from base; tibiae having light band $\frac{1}{4}$ from base. *Abdomen*: A light triangle medially on each tergite, base on anterior margin; a light mark either side of and curved convexly towards each triangle except on tergite X, which has two dark spots either side of triangle. Gills with filaments shorter than those of other species in genus. Cerci short, almost width of pronotum.



Figs. 40–44.—Nymph of *Aucklandobius spiniger* (Tillyard). Fig. 40—Dorsal view of nymph. Fig. 41—Left mandible, ventral view. Fig. 42—Left maxilla, ventral view. Fig. 43—Tip of abdomen, ventral view. Fig. 44—Nota of early instar nymph, lateral view.



Figs. 45–49.—Nymph of *Megaleptoperla grandis* (Hudson). Fig. 45—Dorsal view of nymph. Fig. 46—Left mandible, ventral view. Fig. 47—Left maxilla, ventral view. Fig. 48—Tip of abdomen, ventral view. Fig. 49—Labium, ventral view.

Material. Holotype female and allotype male (Ent. Div., D.S.I.R., Nelson). 1 male (ex Hutton collection, Cant. Mus.); 1 female, Rahu Saddle, 25/i/65, author's collection; 3 nymphs, Waipuna Stream, National Park, —/x/49, E. G. Turbott (Cant. Mus.); 1 nymph, no data (Cant. Mus.); 3 nymphs, Alford Forest, 7/ii/65, J. G. Penniket (Cant. Mus.).

Nymphs of early instars have more pronounced notal spines, particularly on the meso- and meta-nota, Text-fig. 44.

Megaleptoperla grandis (Hudson, 1913)

Leptoperla grandis Hudson, 1913. *Trans. N.Z. Inst.*, 45: 51.
Megaleptoperla grandis: Tillyard, 1923. *Trans. N.Z. Inst.*, 54: 204.
Megaleptoperla grandis: Kimmins, 1938. *Ann. Mag. Nat. Hist.*, 11:2:566.

Nymph. Text-figs. 45, 46, 47, 48, 49. Measurements of male: Body 17.5mm, antennae, 11mm; cerci, 5mm. Measurements of female: Body, 22mm; antennae, 12mm; cerci, 6mm. *Colour*: Dorsally brown to dark brown, sometimes with light markings along mid-line of abdomen and indistinct light markings on pronotum; ventrally light brown. *Head*: Segments of antennae short, scape large. Ocelli present. Maxillary palp with 4th and 5th segments well developed, both being as long as segment 3. Lacinia with three strong teeth. Mandible with five teeth, the apical two well developed. *Thorax*: Pronotum, rectangular, having anterior angles produced and rounded; posterior angles produced and pointed. Posterior margins of nota convex. Wing pads divergent. *Legs*: Clothed in short bristles. Femora and tibia with hairy fringe on hind margins. *Abdomen*: Subanal lobe quadrangular with posteriorly directed spine. Anal rosette having many filaments. Cerci with dorsal fringe of hairs.

Material. Author's collection: Ohikanui River, 2 nymphs, 22/x/62; 3 nymphs, 25/vii/64; 5 nymphs, 3/x/64; 6 nymphs, 17/x/64; 5 nymphs, 31/x/64; 4 nymphs, 5/xii/64; 1 male, 2 females, from nymphs collected 7/ii/65, which emerged 10/ii/65; Rough River, Grey Valley, 2 nymphs, 15/xii/64; Stony River, Inangahua Valley, 2 nymphs, 14/i/64; 3 nymphs, —/ii/64; Tiropahi River, 4 nymphs, 24/viii/63. Ten Mile Creek, Buller Gorge, 5 nymphs, —/iii/63; 1 nymph, 10/vii/64; 1 nymph, 29/v/65; Windy Point Creek, Lower Buller Gorge, 1 nymph, 9/iv/65; Hawke's Crag Creek, Lower Buller Gorge, 3 nymphs, 18/viii/63. Canterbury Museum collection: 8 nymphs, 2 exuviae, Makotote, 14/i/65, J. G. Penniket; 3 nymphs, no data; 1 nymph, Mahria? 29/xii/64, J. G. Penniket; 1 nymph, Kiwi Creek, Boulder Lake, 27/x/63, V. Stout; 1 nymph, Hawden River tributary, Cass, 13/x/60, V. Stout; 3 nymphs, Pirongia, 3/i/65, J. G. Penniket; 1 male, Waiwakakaiho River, 8/ii/58, A. G. McFarlane.

Bionomics. During mid and late summer nymphal exuviae appeared in numbers, but no imagines were collected despite constant searching in daylight hours. Three imagines which were reared from nymphs emerged during the hours of darkness, between 10 p.m. and 1.30 a.m. A noticeable characteristic of the nymphs is a rhythmic pulsation of the anal gills.

Sexual Dimorphism

Female imagines and nymphs are, as a rule, larger than males. The greatest size difference is found in *Z. fenestrata* and *M. grandis* where females are one-fifth to one-sixth larger than males.

The sex of nymphs of the last instar can be easily determined. In males the genitalia can be seen forcing up tergite X and in females the subgenital plate can be seen through the nymphal integument while tergite X is usually rounder than that of males.

Key to Nymphs of Gripopterygidae

(For late instars only.)

1 (a) Subanal lobes tongue-shaped; distal segment of maxillary palp twice as long as 4th .... *Zelandobius*

(b) Subanal lobes not tongue-shaped; distal segment of maxillary palp shorter or not much longer than 4th 2

2 (a) Subanal lobes sub-quadrangular, with posterior spine ..... *Megaleptoperla*

(b) Subanal lobes triangular without posterior spine 3

3 (a)	Cerci longer than ½ body length; mandible with hollow apex; hairy fringe on legs	*Zelandoperla*
(b)	Cerci shorter than ½ body length; usually with light markings dorsally on abdomen; no hairy fringe on legs	4
4 (a)	With wing pads and ocelli	*Aucklandobius*
(b)	Without wing pads, without ocelli	*Apteryoperla*

GENERIC FEATURES OF NYMPHS

Zelandobius: Small nymphs, 6–10mm in length. Subanal lobes tongue-shaped. Tergite X usually long in comparison with other genera. Distal segment of maxillary palp almost twice as long as 4th. Pronotum rectangular or almost square. No fringe on legs. Wing pads divergent or held close to body.

Zelandoperla: Medium sized nymphs, 11–16mm in length. Subanal lobes triangular. Distal segment of maxillary palp slightly longer than 4th. Mandible with hollow apex. Pronotum with dark ornate markings. Fringe on legs. Wing pads divergent. Cerci longer than half body length.

Aucklandobius: Medium sized nymphs, approximately 10mm in length. Subanal lobes triangular. Distal segment of maxillary palp shorter than 4th (*Aucklandobius complementarius* the exception). Pronotum usually with ornate light and dark markings. Abdomen with light markings dorsally. No fringe on legs. Wing pads divergent. Cerci shorter than half body length.

Apteryoperla: As for *Aucklandobius* but with no wing pads or ocelli and a shorter distal segment of maxillary palp than *Aucklandobius*.

Megaleptoperla: Medium to large nymphs 13–22mm in length. Subanal lobes quadrangular with posterior spine. Segments 3, 4 and 5 of maxillary palp equal in length. Pronotum with angles produced. Fringe of hairs on legs. Wing pads divergent. Cerci less than ½ body length. Gill rosette with many closely packed filaments.

DIAGNOSTIC FEATURES OF SPECIES

(Generic features excluded.)

Zelandobius confusus: Body length, male and female, 7mm. Clothing consisting of very short bristles. Pronotum almost square. In side view tergite X is level dorsally. Gills pink. Cerci about half body length. Wing pads held close to body.

Zelandoperla fenestrata: Body length of male 13mm, female 15.5mm. No distinct comb on basal grinding plate. Pronotum with posterior margin straight. Mesonotum with posterior margin convex. Dorsal callosities dark brown and hairless. Tergites with short curved lines, one fifth as wide as long. Inner margins of cerci fringed with hairs.

Zelandoperla decorata: Body length, male and female, 11.5mm. Distinct comb on basal grinding plate. Pronotum with posterior margin concave. Posterior margin of mesonotum convex. Tergites with short marks half as wide as long. Epicranial plates mottled and with medial patch of hairs extending on to frons. Cerci with thick fringe of hairs on inner margins. Fringes and body hairs more dense than *Z. fenestra*.

Aucklandobius trivacuata: Body length, male and female, 10mm. Distinct double comb on basal grinding plate. An ivory triangle on mid-line of each tergite (except tergite X), with its base on the anterior margin. Tibiae brown with ivory band ¼ from base.

Aucklandobius fulvescens: Body length, male and female, 10mm. No comb on basal grinding plate. A dark brown triangle on mid line of each tergite (except

tergite X), the base of triangle on the posterior margin, the sides outlined with a white band. Tibiae grey with two evenly spaced bands of brown.

Aucklandobius spiniger: Body length, male and female, 10mm. Dark triangular markings between dorsal callosities and antennae. Distinct comb on basal grinding plate. Pronotum with each posterior lateral angle produced into a strong projecting spine. Meso- and meta-nota with a spine at the base of each wing pad. Abdomen with a light triangle on each tergite (except tergite X), the base of triangle on anterior margin of tergite.

Megaleptoperla grandis: Body length of male 17.5mm, female 22mm. Pronotum with anterior angles produced and rounded, posterior angles produced and pointed. Cerci with dorsal fringe of hairs.

Discussion

Reference has been made in a previous paper (McLellan, 1965) to the synonymy of *Aucklandobius* Enderlein, 1909, and *Nesoperla* Tillyard, 1923, proposed by Illies (1963).

He stated that the male genitalia of *Apteryoperla* clearly resembled that of *Aucklandobius*. If my descriptions of *Aucklandobius* spp. genitalia are compared with those of *Apteryoperla* spp. described by Illies (1963) and Wisely (1953) this view is strengthened. The general shape of tergite X, the epiproct and paraprocts is similar, and individual species may be assigned to two groups depending on the shape of tergite XI with members of both genera in each group: Group I: (with tergite XI a more or less dorsally projecting peg) *Aucklandobius complementarius, Aucklandobius fulvescens* and *Apteryoperla monticola.*

Group II: (with tergite XI as a plate projecting dorso-posteriorly) *Aucklandobius trivacuata, Aucklandobius spiniger, Apteryoperla angularis,* and *Apteryoperla campbelli.*

Comparison of nymphs of *Aucklandobius fulvescens, Aucklandobius trivacuata* and *Aucklandobius spiniger* with the type material of *Apteryoperla monticola* and *Apteryoperla angularis* show similarity in body form, shortness of distal segment of maxillary palp, and markings on abdomen, nota and legs.

These similarities point towards a closer relationship between the two genera than to *Zelandoperla*, the remaining New Zealand genus in the subfamily Leptoperlinae.

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